DS96F173MQML/DS96F175MQML EIA-485/EIA-422 Quad Differential Receivers

Check for Samples: DS96F173MQML, DS96F175MQML

FEATURES

- **Meets EIA-485, EIA-422A, EIA-423A Standards**
- **Designed for Multipoint Bus Applications**
- **TRI-STATE Outputs**
- **Common Mode Input Voltage Range: −7V to +12V**
- **Operates from Single +5.0V Supply**
- **Lower Power Version**
- **Input Sensitivity of ±200 mV Over Common Mode Range**
- **Input Hysteresis of 50 mV Typical**
- **High Input Impedance**
- **DS96F173 and DS96F175 are Lead and Function Compatible with SN75173/175 or the AM26LS32/MC3486**

DESCRIPTION

The DS96F173 and the DS96F175 are high speed quad differential line receivers designed to meet the EIA-485 standard. The DS96F173 and the DS96F175 offer improved performance due to the use of L-FAST bipolar technology. The use of LFAST technology allows the DS96F173 and DS96F175 to operate at higher speeds while minimizing power consumption.

The DS96F173 and the DS96F175 have TRI-STATE outputs and are optimized for balanced multipoint data bus transmission at rates up to 15 Mbps. The receivers feature high input impedance, input hysteresis for increased noise immunity, and input sensitivity of 200 mV over a common mode input voltage range of −7V to +12V. The receivers are therefore suitable for multipoint applications in noisy environments. The DS96F173 features an active high and active low Enable, common to all four receivers. The DS96F175 features separate active high Enables for each receiver pair.

Connection Diagrams

16-Lead Ceramic Dual-In-Line Package (Package Number NFE0016A)

DS96F173

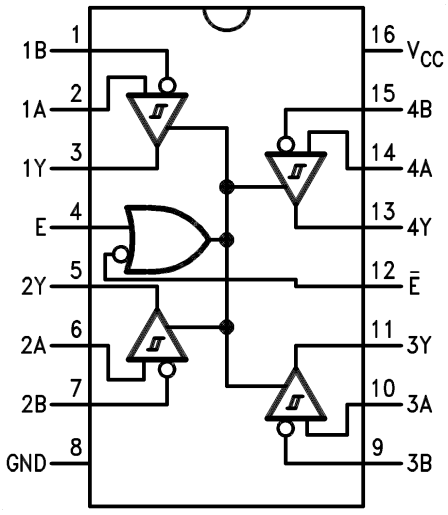


Figure 1. Top View

DS96F175

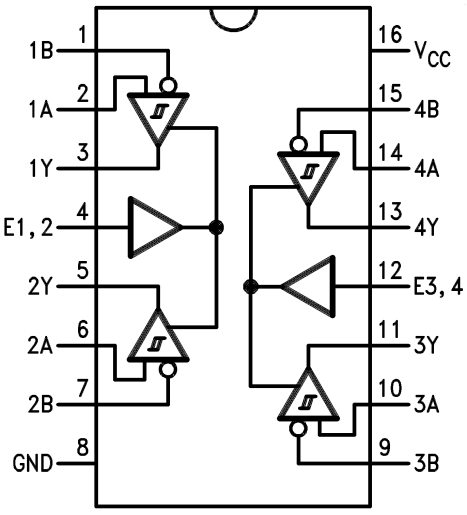


Figure 2. Top View

20-Lead Ceramic Leadless Chip Carrier (Package Number NAJ0020A)

*NC—No Connection

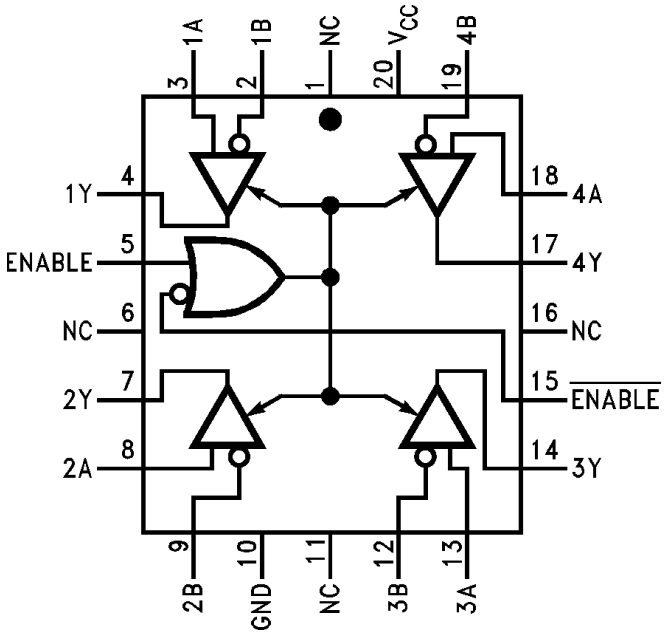


Figure 3. Top View

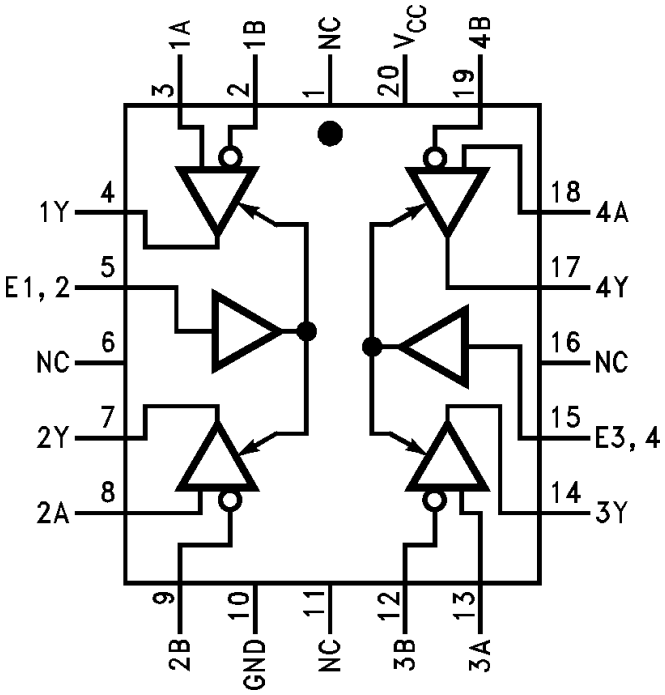
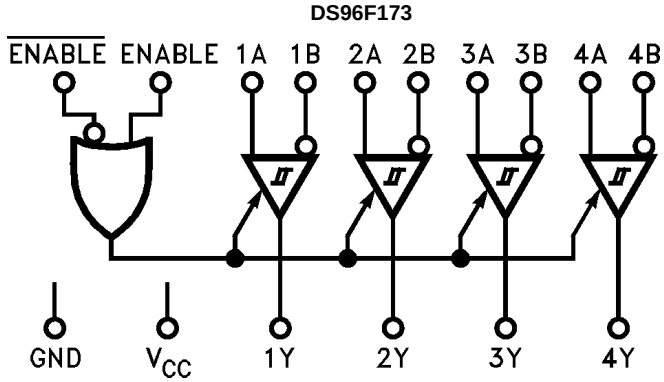
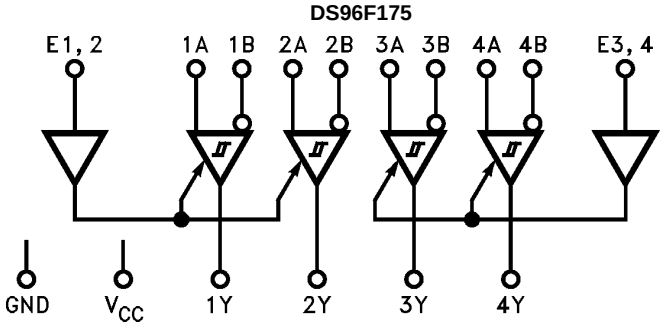


Figure 4. Top View

Logic Diagrams





Function Tables

Table 1. (Each Receiver) DS96F173 (1)

Differential Inputs	Enable		Output
A–B	E	$\overline{E}$	Y
$V_{ID} \geq 0.2V$	H	X	H
	X	L	H
$V_{ID} \leq -0.2V$	H	X	L
	X	L	L
X	L	X	Z
X	X	H	Z

(1) H = High Level
L = Low Level
Z = High Impedance (off)
X = Don't Care

Table 2. (Each Receiver) DS96F175

Differential Inputs	Enable	Output
A–B	E	Y
$V_{ID} \geq 0.2V$	H	H
$V_{ID} \leq -0.2V$	H	L
X	L	Z

These devices have limited built-in ESD protection. The leads should be shorted together or the device placed in conductive foam during storage or handling to prevent electrostatic damage to the MOS gates.

Absolute Maximum Ratings(1)

Storage Temperature Range(T_{Stg})		−65°C ≤ T_A ≤ +175°C
Lead Temperature (Soldering, 60 sec.)		300°C
Max. Package Power Dissipation at 25°C(2)	CDIP (NFE)	1,500 mW
	CDIP (NAD)	1,034 mW
	LCCC (NAJ)	1,500 mW
Supply Voltage		7.0V
Input Voltage, A or B Inputs		±25V
Differential Input Voltage		±25V
Enable Input Voltage		7.0V
Low Level Output Current		50 mA

(1) Absolute Maximum Ratings indicate limits beyond which damage to the device may occur. Operating Ratings indicate conditions for which the device is functional, but do not ensure specific performance limits. For ensured specifications and test conditions, see the Electrical Characteristics--DC Parameters. The ensured specifications apply only for the test conditions listed. Some performance characteristics may degrade when the device is not operated under the listed test conditions.

(2) Above T_A = 25°C derate NFE package 10 mW/°C, NAD package 6.90 mW/°C, NAJ package 11.11 mW/°C.

Recommended Operating Conditions

	Min	Max	Units
Supply Voltage (V_{CC})	4.50	5.50	V
Common Mode Input Voltage (V_{CM})	−7	+12	V
Differential Input Voltage (V_{ID})	−7	+12	V
Output Current HIGH (I_{OH})		−400	µA
Output Current LOW (I_{OL})		16	mA
Operating Temperature (T_A)	−55	125	°C

Quality Conformance Inspection

Mil-Std-883, Method 5005 - Group A

Subgroup	Description	Temp (°C)
1	Static tests at	+25
2	Static tests at	+125
3	Static tests at	-55
4	Dynamic tests at	+25
5	Dynamic tests at	+125
6	Dynamic tests at	-55
7	Functional tests at	+25
8A	Functional tests at	+125
8B	Functional tests at	-55
9	Switching tests at	+25
10	Switching tests at	+125
11	Switching tests at	-55
12	Settling time at	+25
13	Settling time at	+125
14	Settling time at	-55

Electrical Characteristics--DC Parameters

The following conditions apply, unless otherwise specified. V_{CC} = 5.0V, Outputs Enabled

Symbol	Parameter	Conditions	Notes	Min	Max	Units	Sub-groups
I_{CC}	Supply Current	V_{CC} = 5.5V, V_{ID} = 2V	See (1)		50	mA	1, 2, 3
V_{OH}	Logical "1" Output Voltage	V_{CC} = 4.5V, I_{OH} = -400µA, V_{ID} = 0.2V	See (2)	2.5		V	1, 2, 3
V_{OL}	Logical "0" Output Voltage	V_{CC} = 4.5V, I_{OL} = 8mA, V_{ID} = -0.2V	See (2)		0.45	V	1, 2, 3
V_{TH}	Differential-Input High Threshold Voltage	V_{CC} = 4.5V & 5.5V, V_{CM} = 0V, V_O = 2.5V, I_O = -400µA			0.20	V	1, 2, 3
		V_{CC} = 4.5V & 5.5V, V_{CM} = -12V, V_O = 2.5V, I_O = -400µA			0.20	V	1, 2, 3
		V_{CC} = 4.5V & 5.5V, V_{CM} = 12V, V_O = 2.5V, I_O = -400µA			0.20	V	1, 2, 3
V_{TL}	Differential-Input Low Threshold Voltage	V_{CC} = 4.5V & 5.5V, V_{CM} = 0V, V_O = 0.5V, I_O = 16mA		-0.20		V	1, 2, 3
		V_{CC} = 4.5V & 5.5V, V_{CM} = -12V, V_O = 0.5V, I_O = 16mA		-0.20		V	1, 2, 3
		V_{CC} = 4.5V & 5.5V, V_{CM} = 12V, V_O = 0.5V, I_O = 16mA		-0.20		V	1, 2, 3
I_I	Input Line Current	V_{CC} = 4.5V, V_I = 12V, Untested Inputs are 0V			1.0	mA	1, 2, 3
		V_{CC} = 5.5V, V_I = -7V, Untested Inputs are 0V		-0.8		mA	1, 2, 3
I_{IH}	Logical "1" Enable Input Current	V_{CC} = 5.5V, V_{IH} = 2.7V			10	µA	1, 2, 3
I_{IL}	Logical "0" Enable Input Current	V_{CC} = 5.5V, V_{IL} = 0.4V		-100		µA	1, 2, 3
I_{OS}	Output Short Circuit Current	V_{CC} = 4.5V, V_O = 0V	See (3)	-85	-15	mA	1, 2, 3
		V_{CC} = 5.5V, V_O = 0V		-85	-15	mA	1, 2, 3
V_{IK}	Enable Input Clamp Voltage	V_{CC} = 4.5V, I_I = -18mA		-1.5		V	1, 2, 3
I_{OZ}	High Impedance Output Current	V_{CC} = 5.5V, V_{En} = 0.8V, V_O = 0.4V, Outputs disabled		-20	20	µA	1, 2, 3
		V_{CC} = 5.5V, V_{En} = 0.8V, V_O = 2.4V, Outputs disabled		-20	20	µA	1, 2, 3
V_{IH}	Logical "1" Enable Input Voltage		See (4)	2.0		V	1, 2, 3
V_{IL}	Logical "0" Enable Input Voltage		See (5)		0.8	V	1, 2, 3
R_I	Input Resistance			10		kΩ	1, 2, 3

(1) I_{CC} is tested with outputs disabled (worst case), I_{CC} enabled is ensured by this test.
(2) V_{OH} & V_{OL} are tested over common mode voltage range of +/−12V via the V_{TH} / V_{TL} tests.
(3) Only one output at a time should be shorted.
(4) Ensured by V_{OL} & V_{OH} tests.
(5) Ensured by I_{OZ} test.

AC Parameters

The following conditions apply, unless otherwise specified. V_{CC} = 5.0V

Symbol	Parameter	Conditions	Notes	Min	Max	Units	Sub-groups
t_{PHL}	Propagation Delay	C_L = 15pF			22	ns	1
					30	ns	2, 3
t_{PLH}	Propagation Delay	C_L = 15pF			22	ns	1
					30	ns	2, 3
t_{PZH}	Propagation Delay	C_L = 15pF			16	ns	1
					27	ns	2, 3
t_{PZL}	Propagation Delay	C_L = 15pF			18	ns	1
					27	ns	2, 3
t_{PHZ}	Propagation Delay	C_L = 5pF	See (1)		20	ns	1
					27	ns	2, 3
		C_L = 20pF			30	ns	1
					37	ns	2, 3
t_{PLZ}	Propagation Delay	C_L = 5pF			18	ns	1
					30	ns	2, 3
t_{PW}	Propagation Delay				3.0	ns	1
					8.0	ns	2
					5.0	ns	3

(1) Testing at 20pF assures conformance to spec at 5pF.

PARAMETER MEASUREMENT INFORMATION

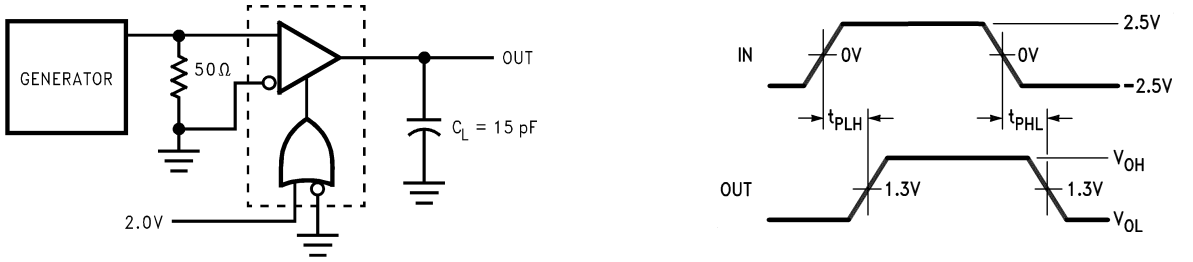


Figure 5. t_{PLH}, t_{PHL} (2)(3)

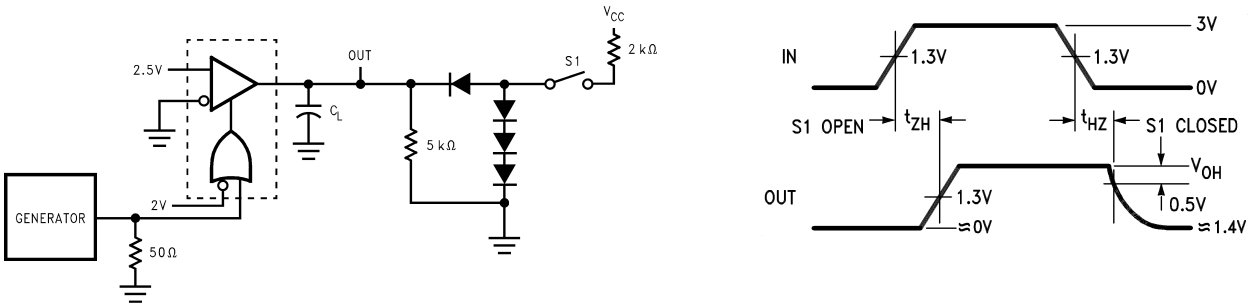


Figure 6. t_{HZ}, t_{ZH} (2)(3)(4)(5)

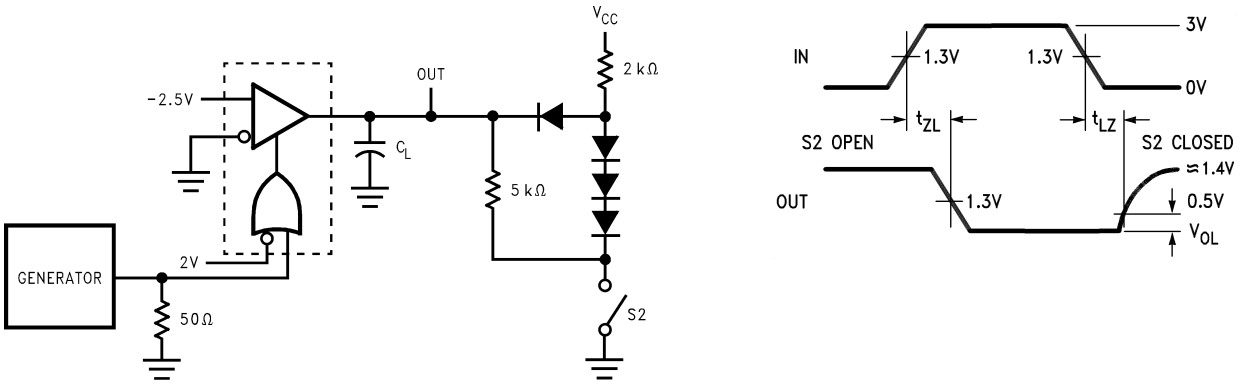


Figure 7. t_{ZL}, t_{LZ} (2)(3)(4)(5)

(2) The input pulse is supplied by a generator having the following characteristics: f = 1.0 MHz, 50% duty cycle, $t_r \le 6.0$ ns, $t_f \le 6.0$ ns, Z_O = 50Ω.
(3) C_L includes probe and stray capacitance.
(4) All diodes are 1N916 or equivalent.
(5) To test the active low Enable $\overline{E}$ of DS96F173, ground E and apply an inverted input waveform to $\overline{E}$. DS96F175 has active high enable only.

Typical Application

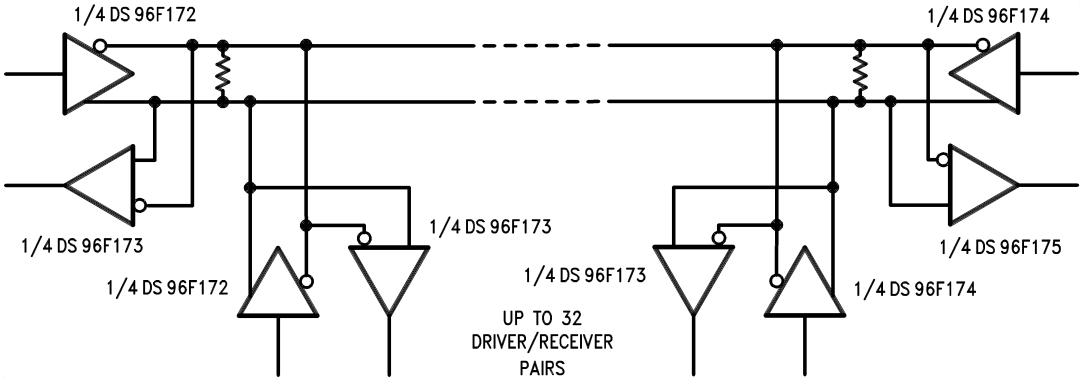


Figure 8.

NOTE

The line length should be terminated at both ends in its characteristic impedance. Stub lengths off the main line should be kept as short as possible.

REVISION HISTORY

Released	Revision	Section	Changes
28–Apr-11	A	New Release, Corporate format	2 MDS data sheets converted into one Corp. data sheet format. MNDS96F173M-X Rev 0A0 & MNDS96F175M-X Rev 0B0 will be archived.

Changes from Original (April 2013) to Revision A **Page**

- Changed layout of National Data Sheet to TI format 8

PACKAGING INFORMATION

Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead finish/ Ball material (6)	MSL Peak Temp (3)	Op Temp (°C)	Device Marking (4/5)	Samples
5962-9076601M2A	ACTIVE	LCCC	NAJ	20	50	RoHS & Green	Call TI	Level-1-NA-UNLIM	-55 to 125	DS96F175ME /883 Q 5962-90766 01M2A ACO 01M2A >T	Samples
5962-9076601VEA	ACTIVE	CDIP	NFE	16	25	Non-RoHS & Green	Call TI	Level-1-NA-UNLIM	-55 to 125	DS96F175MJ-QMLV 5962-9076601VEA Q	Samples
5962-9076602M2A	ACTIVE	LCCC	NAJ	20	50	RoHS & Green	Call TI	Level-1-NA-UNLIM	-55 to 125	DS96F173ME /883 Q 5962-90766 02M2A ACO 02M2A >T	Samples
5962-9076602MEA	ACTIVE	CDIP	NFE	16	25	Non-RoHS & Green	Call TI	Level-1-NA-UNLIM	-55 to 125	DS96F173MJ/883 5962-9076602MEA Q	Samples
DS96F173ME/883	ACTIVE	LCCC	NAJ	20	50	RoHS & Green	Call TI	Level-1-NA-UNLIM	-55 to 125	DS96F173ME /883 Q 5962-90766 02M2A ACO 02M2A >T	Samples
DS96F173MJ/883	ACTIVE	CDIP	NFE	16	25	Non-RoHS & Green	Call TI	Level-1-NA-UNLIM	-55 to 125	DS96F173MJ/883 5962-9076602MEA Q	Samples
DS96F175ME/883	ACTIVE	LCCC	NAJ	20	50	RoHS & Green	Call TI	Level-1-NA-UNLIM	-55 to 125	DS96F175ME /883 Q 5962-90766 01M2A ACO 01M2A >T	Samples
DS96F175MJ-QMLV	ACTIVE	CDIP	NFE	16	25	Non-RoHS & Green	Call TI	Level-1-NA-UNLIM	-55 to 125	DS96F175MJ-QMLV 5962-9076601VEA Q	Samples

(1) The marketing status values are defined as follows:
ACTIVE: Product device recommended for new designs.
LIFEBUY: TI has announced that the device will be discontinued, and a lifetime-buy period is in effect.
NRND: Not recommended for new designs. Device is in production to support existing customers, but TI does not recommend using this part in a new design.
PREVIEW: Device has been announced but is not in production. Samples may or may not be available.
OBSOLETE: TI has discontinued the production of the device.

(2) **RoHS:** TI defines "RoHS" to mean semiconductor products that are compliant with the current EU RoHS requirements for all 10 RoHS substances, including the requirement that RoHS substance do not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, "RoHS" products are suitable for use in specified lead-free processes. TI may reference these types of products as "Pb-Free".
RoHS Exempt: TI defines "RoHS Exempt" to mean products that contain lead but are compliant with EU RoHS pursuant to a specific EU RoHS exemption.
Green: TI defines "Green" to mean the content of Chlorine (Cl) and Bromine (Br) based flame retardants meet JS709B low halogen requirements of <=1000ppm threshold. Antimony trioxide based flame retardants must also meet the <=1000ppm threshold requirement.

(3) MSL, Peak Temp. - The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications, and peak solder temperature.

(4) There may be additional marking, which relates to the logo, the lot trace code information, or the environmental category on the device.

(5) Multiple Device Markings will be inside parentheses. Only one Device Marking contained in parentheses and separated by a "~" will appear on a device. If a line is indented then it is a continuation of the previous line and the two combined represent the entire Device Marking for that device.

(6) Lead finish/Ball material - Orderable Devices may have multiple material finish options. Finish options are separated by a vertical ruled line. Lead finish/Ball material values may wrap to two lines if the finish value exceeds the maximum column width.

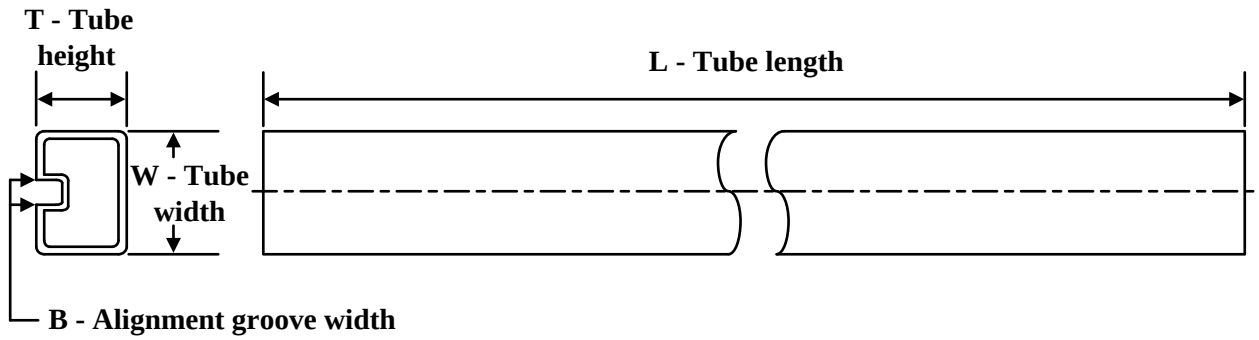
OTHER QUALIFIED VERSIONS OF DS96F175MQML, DS96F175MQML-SP :

- Military : DS96F175MQML
- Space : DS96F175MQML-SP

NOTE: Qualified Version Definitions:

- Military - QML certified for Military and Defense Applications
- Space - Radiation tolerant, ceramic packaging and qualified for use in Space-based application

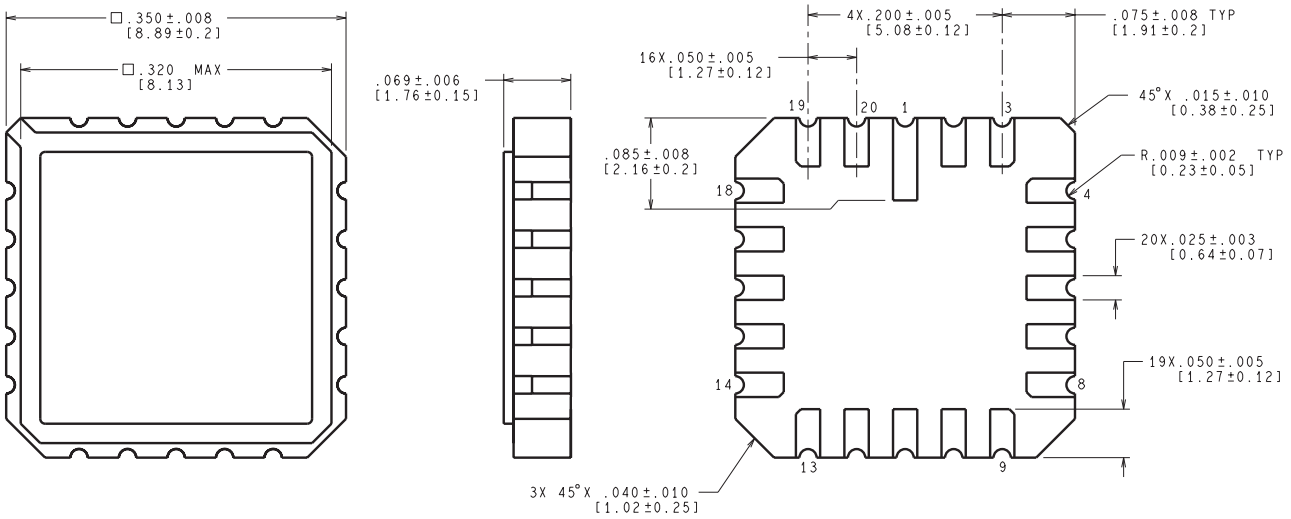
TUBE



*All dimensions are nominal

Device	Package Name	Package Type	Pins	SPQ	L (mm)	W (mm)	T (µm)	B (mm)
5962-9076601M2A	NAJ	LCCC	20	50	470	11	3810	0
5962-9076601VEA	NFE	CDIP	16	25	506.98	15.24	13440	NA
5962-9076602M2A	NAJ	LCCC	20	50	470	11	3810	0
5962-9076602MEA	NFE	CDIP	16	25	506.98	15.24	13440	NA
DS96F173ME/883	NAJ	LCCC	20	50	470	11	3810	0
DS96F173MJ/883	NFE	CDIP	16	25	506.98	15.24	13440	NA
DS96F175ME/883	NAJ	LCCC	20	50	470	11	3810	0
DS96F175MJ-QMLV	NFE	CDIP	16	25	506.98	15.24	13440	NA

NAJ0020A



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E20A (Rev F)

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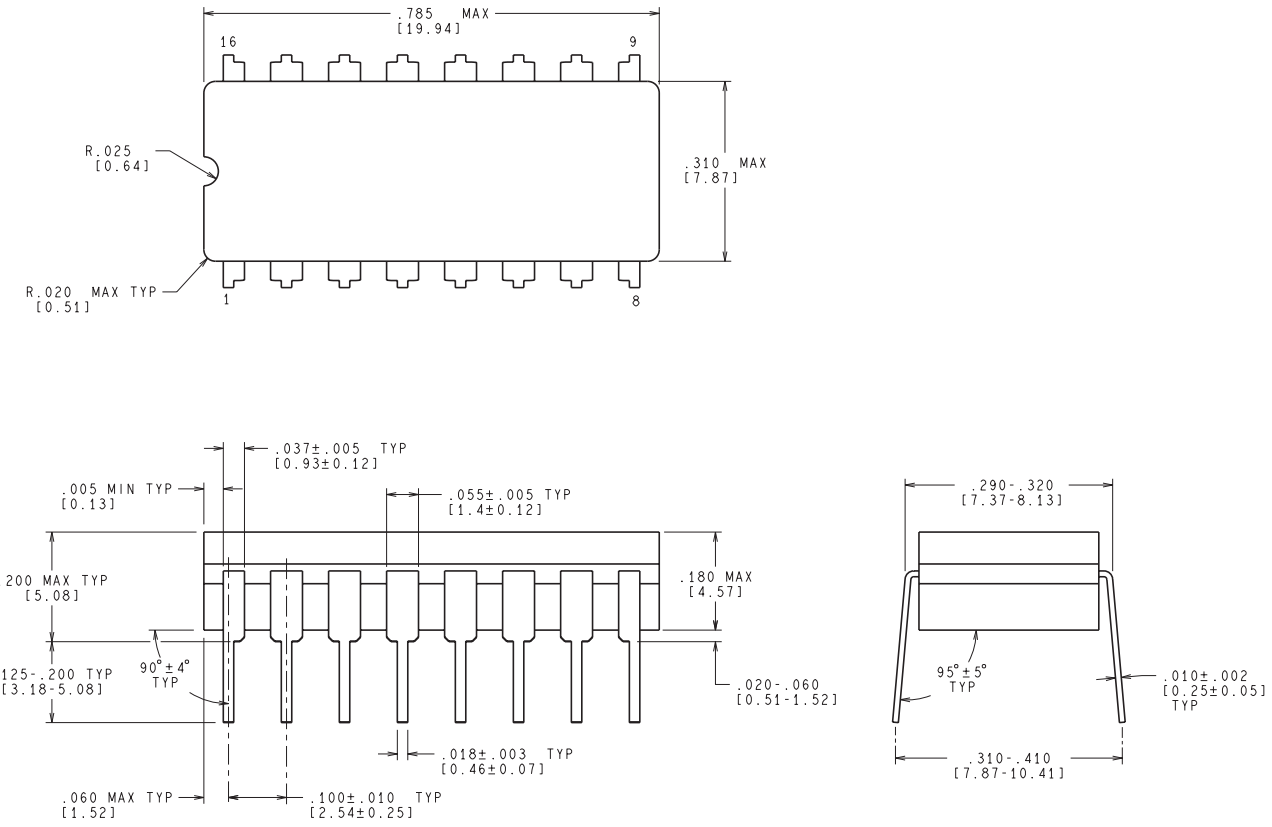

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J16A (REV L)

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